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# I. Target Systems

## A. The Prime Economic Target System

The term "prime economic target system" of North Vietnam describes the modern industrial base upon which the long-term economic development of the DRV depends. This industrial base or "system" includes modern industry, which presently accounts for about one-half of gross industrial output, and the transportation networks which supply the inputs to the modern industrial sector and distribute its products. Specific targets of a postulated air offensive against this system are eight electric power facilities, <sup>NINE</sup> petroleum storage facilities, 47 transportation targets, and 15 industrial plants.

### 1. Electric Power Facilities

The electric power facilities which would be put out of operation as the result of the postulated attacks are the thermal powerplants at Hanoi, Thai Nguyen, and Hon Gai, and the Dong Anh transformer sub-station which feeds power from three sources to the city of Hanoi. In addition, the thermal powerplants at Viet Tri, Haiphong city, the Haiphong cement plant, and at Lao Cai would also become inoperable.\* Destruction of these facilities would raise the total loss of power-generating capacity to 160,000 kilowatts, or 91 percent of national capacity. These strikes would bring modern industry in the affected areas to a complete halt and would severely disrupt the highly electrified operations at the port of CamPha.

Among the major industrial installations that would be forced to shut down are the Hanoi machine-building plant, the Hanoi rubber products plant, the Nam Dinh textile plant, the March 8 textile plant, the Thai Nguyen iron and steel plant and iron ore mines, the Hon Gai coal mines, the paper mill, chemical combine and sugar refinery at Viet Tri, the Haiphong cement plant and phosphate plant, and the Lao Cai apatite mines. In most cases, these enterprises are the major if not the exclusive producers of their products in the country. Further, many of them were built with Soviet and Chinese assistance and are highly regarded show projects.

\* For a listing of these targets, see Table 1.

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### 3. Rail, Highway, and Sea Transportation

Under the terms of the postulated escalation of air attacks, 41 targets in the rail, highway, and sea transportation system of North Vietnam are suggested. The 22 major rail, highway, or combination rail/highway bridges on the JCS target list would continue to be interdicted. These targets are on the transport routes that connect the major industrial centers with each other and with P'ing-hsiang, China, and the port of Haiphong. In addition, 17 other transport targets on the same routes, four port facilities (Hanoi, Haiphong, Hon Gai, and CamPhu), three mineable areas (Haiphong, Hon Gai, and CamPhu) and the major railroad repair shop near Hanoi are also included in the JCS list.\*

A minimum of <sup>2,330</sup>~~2,800~~ sorties is estimated as the requirement for initial attacks on these transportation targets. Of this total, <sup>2,226</sup>~~2,696~~ sorties, including <sup>1,402</sup>~~1,686~~ strike and <sup>824</sup>~~1,010~~ support aircraft, is allocated to the 44 transportation targets vulnerable to conventional aerial bombing. Ordnance requirements for these targets is estimated to be 2,030 tons. The remaining 104 sorties, including 64 strike and 40 support aircraft, are allocated to mining operations against three mineable areas. The ordnance requirement for these targets is estimated to be 190 mines of assorted types. At least 2 percent of the total force, or 56 aircraft, would be lost to the air defenses in the target areas. In addition to these sorties, an unknown but probably large number of re-strikes would be required on about 75 percent of these targets in order to counter North Vietnamese efforts to return them to operation.

If all of these targets were effectively and repeatedly attacked in an escalated bombing schedule, it could be assumed that rail transport would almost cease.\*\* Truck transport, on the other hand, probably would be disrupted but would

\* For a listing of these targets, see Table 1.

\*\* The experience during World War II and the Korean War suggests that this assumption is unrealistic. The objective of keeping these bridges and lines of communication constantly interdicted to the degree necessary to halt all rail traffic is probably impossible to attain. Bombing and strafing missions would have to exceed considerably the maximum of 1,200 armed reconnaissance sorties allowed under any previous two-week Rolling Thunder authorization. Therefore, some rail traffic would always be able to move between the interdicted sections of a given route, and some through movements would be accomplished by improvisation. Although the amount of through movement cannot be quantified, it will not be large enough to invalidate the general conclusions and analysis of this estimate.

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continue to meet essential requirements by the use of alternate routes, fords, ferries, and pontoon bridges, where necessary. Seaborne foreign trade would also be greatly restricted, and domestic water transport would be handicapped. Water and motor transport and port operations would be further restricted if the major petroleum storage and electric power facilities were destroyed.

The elimination of rail transport and the reduction of motor and water transport would seriously affect the over-all availability of transport capacity. Of the 1.8 billion ton-kilometers performed by modern transport in 1964, railroads accounted for a little more than 50 percent, highways 10 percent, inland waterways nearly 30 percent, and coastal waterways nearly 10 percent. In terms of tons carried, railroads accounted for 22 percent, highways 38 percent, and inland water 38 percent, and coastal water 2 percent. The railroads serve mainly the industrial and extractive sections of the economy and the military establishment, whereas highway transport and water transport are used for both these sectors and for a portion of the agricultural sector.

In 1965, Haiphong handled at least 1.2 million tons of seaborne cargo. Import cargo amounted to at least 680,000 tons, of which nearly 170,000 tons consisted of bulk petroleum products, and export cargoes amounted to 550,000 tons, of which 320,000 tons were shipments of apatite ore. Coal exports from the ports of HongGai and CamPha amounted to 1.1 million tons. Additional foreign trade in 1965 via the rail line to China amounted to about 300,000 tons of imports and 150,000 tons of exports. About one-half of these imports are believed to have been coal for the blast furnaces at Thai Nguyen and about 30 percent were probably military supplies.

Thus, with rail transport and the flow of imports through the ports interrupted, modern industry would soon be at a standstill unless there were substantial stockpiles of raw materials at the plants. Even if the plants continued to operate, internal distribution or export of their products would be handicapped by insufficient transport.

a. The Transport of Petroleum

If North Vietnam is forced to forego most of its industry and foreign trade as the result of the escalated attacks, the most crucial item needed to support

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the agricultural economy and the military operation would be petroleum. Nearly all of the petroleum is used for transportation, with about 60 percent allocated to the military and 40 percent to civilian use. It is estimated that 70 percent of the total is used for truck transport, 15 percent for water transport, and the remainder is used for agriculture, air transport, and home use. With the destruction of the major petroleum storage facilities, less than a month's supply of petroleum would be available in the short run. If this could be all allocated to military truck transport, it would possibly keep the trucks running for several weeks. It is unlikely that such an allocation could be made, however, as the fuel would not all be in the proper locations for military use, and some would be used for essential civilian traffic.

In a reasonable period of time, the North Vietnamese with the help of China could organize some emergency supply of petroleum. Tank trucks or trucks with petroleum in drums could be used between the Chinese rail system at P'ing-hsiang and Hanoi, a distance of about 120 miles. Given sufficient time and additional expense and effort the total amount of petroleum normally consumed by North Vietnam -- some 15,000 tons a month -- could be delivered at Fort Bayard in China and moved by rail to P'ing-hsiang. Assuming that trucks could make the round trip from P'ing-hsiang to Hanoi in four days in spite of interdiction, about 800 trucks could probably handle this volume and almost certainly could handle the reduced requirements that would result from attacks on other targets. It is more likely, however, that this method would be used only to supply the Hanoi area and the upper Red River delta. The area along the North Vietnamese coast would most likely be supplied from China by small oceangoing tankers or by barge, junk, or other small craft. The tankers would have to offload into oil barges or lighters, as it is assumed that they could not enter the ports, because of mining and damage to port facilities and craft. Trucks and inland water craft could be used to distribute the petroleum inland from the coast. The capability to maintain almost the normal level of petroleum imports through various emergency procedures makes it rather certain that all military requirements could be satisfied. Even on a worst-case basis the regime could meet its most essential requirement for petroleum -- that needed to maintain the logistic pipeline to South Vietnam. At the end of 1965 the North Vietnam forces in Military Region IV (MR IV) (including the four southern provinces of North Vietnam) were estimated to

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have been consuming petroleum at a rate of roughly 1,500 short tons a month. This petroleum supports three major activities: (1) the maintenance of lines of communication and transport facilities within MR IV and leading from North Vietnam to Laos, (2) the operations associated with the use of MR IV as a military staging area, and (3) the actual movement of men and supplies into Laos and South Vietnam.

Maintaining a monthly import requirement of 1,500 short tons a month would be a severe problem. This amount could, for example, be moved by coastal transport to points in MR IV, thus reducing to a minimum distance the overland haul by motor truck.

The share of the 1,500 short tons of petroleum consumed monthly by MR IV for the actual movement of supplies to South Vietnam is small. At the 1965 scale of combat it would take on the order of 60 short tons of petroleum a month to move the daily external logistic requirement of 12 short tons a day. With the escalation of combat and increase of forces represented by a daily external logistic requirement of 165 short tons a day, the petroleum requirement for the actual movement of supplies would be in the order of 800 short tons a month. This would increase the monthly requirement of MR IV to less than 2,500 short tons of petroleum. This amount is well within the estimated postattack capabilities of North Vietnam.

b. Effect of Attacks on Transportation upon Internal Distribution

If modern industry were forced to a standstill by escalated attacks on transportation, petroleum facilities, and electric powerplants, demands for internal distribution for the industrial sector would be almost eliminated. The reduced demand for petroleum for the industrial sector would permit the allocation of most of the available petroleum to the movement of military supplies, agricultural products, and other civilian necessities such as civil defense items and medicines. This transport capacity, in addition to the use of nonmotorized water craft, carts, bicycles, and other forms of native transport, would probably take care of all essential civilian and military distribution.

The immediate and direct effect of the interdiction of the transportation system on the availability of food would be minimal. The major harvest of the year has

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been completed, and the marketed crop probably has already been moved into the cities. Existing food storage facilities in the countryside are so decentralized that they require very little transportation.

The food situation in the cities, mainly Hanoi, Haiphong and Nam Dinh apparently has not been good in recent years. In 1964 and 1965, North Vietnam's imports of food are estimated to have been between 100,000 and 200,000 tons, or an amount equal to about 2 to 4 percent of the annual rice crop. The interdiction of these imports would cause some further tightening of belts but would not be calamitous.

#### 4. Industrial Targets

As noted earlier, successful air attacks upon the eight remaining electric power facilities in North Vietnam would eliminate the power sources for thirteen major industrial facilities and, as a result, would bring the bulk of modern industrial activity in the DRV to a halt. Nevertheless, physical destruction of these and other industrial plant facilities could have considerable psychological impact upon the regime. Both the time and resources required for reconstruction of these facilities -- in addition to the requirements for replacing damaged electric power facilities -- would further set back North Vietnamese plans for eventual industrialization. In this case, a total of fifteen industrial targets would be subject to attack.\*

Hanoi Machine-Building Plant This modern plant, which was a key Soviet aid project, is highly prized by the North Vietnamese as a symbol of advanced technology.

Thai Nguyen Iron and Steel Plant This 100,000 ton steel mill, which is being built with Chinese aid, is the most expensive foreign aid project to be built in North Vietnam. The plant is already producing pig iron and was expected to be producing crude steel and some rolled products by the end of 1965.

Haiphong Cement Plant This plant is the only significant cement producer in North Vietnam. It supplies nearly all the cement for construction and bomb-damage reconstruction activity in the country and has had an important export capability.

\* For a listing of these targets, see Table 1. Three important extractive industry facilities are not suitable targets for direct air attacks and are not included in this list: the Thai Nguyen iron ore mines, the Hon Gai coal fields, and the Lao Cai apatite mines. Nevertheless, these targets would cease operations as the result of successful destruction of the electric power facilities.

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Viet Tri Chemical Combine This new plant, built by the Chinese and East Germans, is the center of the industrial chemicals industry in North Vietnam.

Len Thao Superphosphate Fertilizer Plant This new installation, with a present capacity of 100,000 tons annually, is the largest operating chemical fertilizer plant in North Vietnam. The plant is a major Soviet aid project and its capacity is being expanded to 150,000 tons annually.

Ha Bac Nitrogenous Fertilizer Plant This major new chemical fertilizer plant is a technically advanced Chinese aid project. The plant, scheduled to go into operation in 1966, will have an initial capacity of 100,000 tons of ammonium nitrate. It is of major importance to agriculture but may also be the means of establishing an explosives industry in North Vietnam.

Lang Chi Explosives Plant This plant, producing about 1,000 tons of explosives annually, is the only explosives plant in North Vietnam.

Haiphong Phosphate Plant This plant, with a capacity of 25,500 tons of phosphate fertilizer per year, is North Vietnam's second largest fertilizer plant currently in operation.

Ham Dinh Textile Plant This plant is the largest producer of cotton fabric in North Vietnam and was reconstructed in 1956 and subsequently expanded with Chinese Communist aid.

Viet Tri Paper Mill This plant was built with Chinese aid and has a capacity of 10,000 metric tons. The plant began initial operation in 1961.

Viet Tri Sugar Refinery. This plant, which was built with Chinese and Polish aid, went into operation in 1960.

Tran Hung Dao Machinery Plant This plant is the second largest machinery and equipment producer in North Vietnam.

March 8 Textile Mill This plant, which has the capacity to produce 30 million meters of cotton fabric annually, was built with Chinese aid and began operation in 1964.

Van Bieu Sugar Mill This plant is the largest operating sugar processing plant in North Vietnam. The plant was built with Chinese and Polish aid and began operation in 1961.

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Hanoi Rubber Products Plant This plant is the only significant producer of auto and cycle tires in North Vietnam.

The minimum number of sorties required to immobilize these targets is estimated at 512 -- comprising 226 strike aircraft and 286 support aircraft. The estimated rate of loss to air defenses around these targets is 2 percent, or 10 aircraft. The ordnance requirement is estimated at 571 tons.

If air attacks were limited only to the three targets on the above list which remained unaffected by destruction of the electric power facilities (i.e., the Lam Thao and Ha Bac fertilizer plants and the Lang Chi explosives plant), force requirements would be much lower. In this case it is estimated that 176 sorties -- comprised of 120 strike aircraft and 56 support aircraft -- and an ordnance requirement of <sup>337</sup>~~571~~ tons would be necessary.

#### 5. Direct Effects on Economic Activity

The successful execution of the air offensive postulated in this memorandum would bring activity in the modern industrial sector to a quick halt. The losses resulting from these attacks would be serious and would create severe hardships. They would not, however, preclude continued support for the Communist forces in South Vietnam, nor is it likely that these economic losses alone compel the leadership of North Vietnam to enter into negotiations to end the war in Vietnam.

The speed and extent of the breakdown of North Vietnam's modern industrial sector would depend on the way in which the attack was carried out. The fullest and most immediate impact on the economy would be achieved by the simultaneous and swift execution of all of the assumed attacks on electric power installations, petroleum storage facilities, industrial facilities, internal lines of communications, major port facilities, and the aerial mining of major ports. On the other hand a slower schedule could possibly have a greater harmful impact on public morale through the combined effects of exposure to air attacks over a longer period of time and the frustrations of trying to cope with reconstruction and repair problems under conditions of repeated strikes and restrikes on targeted areas.

The escalated air offensive analyzed in this memorandum would stop almost all modern industrial activity for a number of reasons. The attack on electric power

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installations would raise total losses in generating capacity to 168,000 kilowatts, or 91 percent of total generating capacity that existed before the onset of the Rolling Thunder program. Almost all of modern industry -- the exceptions being minor mining activity in the extreme north -- would cease operations. Activity at the port of CamPhu would also be severely disrupted. From 30 to 40 percent of the electric power supplied to agriculture would be cut off. The effect here would not be felt until the spring harvest. The degree to which agriculture would be affected cannot be estimated without specific knowledge of the areas affected and the measures which might be adopted to offset the loss of power supply. The attack on electric power facilities would be sufficient to prevent a complete restoration of North Vietnam's main power grid for a period of at least one to two years.

The attack on petroleum storage facilities would eliminate more than 75 percent of national storage capacity, but the effect of this loss on economic and military activity would be only temporary. The immediate economic effects would be felt only slightly in industry, which does not use petroleum as an energy source. The major impact would be on transport. The distribution of food, raw materials, and finished products would be rather thoroughly disrupted. Stockpiles of petroleum available after the attack would amount to less than a month's normal requirements. Within a short time, however, the regime could probably cope successfully with the loss of petroleum storage. Essential civilian transport in the postattack situation could be handled by other than motorized vehicles. Military transport could be satisfied by emergency measures to bring in essential petroleum requirements.

The initial destruction and continued interdiction of transport targets would cause rail transportation to cease almost completely. Seaborne foreign trade would be greatly reduced by the mining of the major ports and attacks on port facilities. Many of the transport problems in the civilian sector would be ameliorated by the reduced requirements for transport that would result from the cessation of most industrial production and the inability to maintain most export trade. The immediate problems associated with distribution of food are lessened by the fact that the harvest is already in and distributed. Moreover, the highly decentralized system of food storage lessens the requirement for transportation.

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The most immediate effect of attacks on the industrial facilities would probably be the relocation of the labor force of these plants -- on the order of between 50 and 100,000 skilled laborers -- and their re-employment in repair, reconstruction, and agricultural production tasks in rural areas. Repercussions upon other economic activities which depend upon modern industry, would probably lead to the eventual release of more than 500,000 workers from their normal jobs. Over the longer-term, these attacks would heavily damage, if not eliminate, the key production facilities which constitute the core of North Vietnamese plans for future industrialization. The resources and time required to reconstruct these plant add up to a further postponement of the time when the regime can embark on a program of rapid economic growth.

Analysis of the Rolling Thunder program in 1965 suggests that a minimum total of <sup>3,600</sup> ~~4,100~~ sorties carrying about 3,600 tons of ordnance plus a large number of continuing restrike sorties would be required to successfully immobilize all of these targets. The experience gained by the authorities and population of North Vietnam from air attacks in 1965 and the existence of apparently reliable early warning and civil defense dispersion systems in the areas of these targets suggests that civilian casualties in such attacks would range between 2,000 and 3,000. Further, most of these casualties would be suffered by the skilled manpower segment of the North Vietnamese population since large numbers of such individuals are employed in or live in close proximity to these installations. Nevertheless, even if all the estimated casualties resulting from these attacks were assumed to be skilled, their loss would constitute only about 1 percent of North Vietnam's total skilled labor force (300,000).

Medical services in North Vietnam are inadequate to meet the nation's normal public health needs. These services, therefore, can provide only minimum emergency care and treatment of additional civilian casualties. The small numbers of civilian medical and paramedical personnel (estimated to include 1,400 physicians, 2,300 doctors' assistants, and 8,000 nurses in 1965), most of whom are poorly trained, are unable to cope with the high incidence of nutritional, infectious, and parasitic diseases. They presumably have been hard-pressed to service the relatively few war casualties sustained thus far. The civilian and military hospitals (only 25,000 beds),

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convalescent homes, and village medical stations are, with few exceptions, poorly equipped and chronically overcrowded. Moreover, with the exception of several important combat-related items, medicines are in short supply. The exceptions are mainly penicillin, blood plasma, and sulfa drugs, large stocks of which have been accumulated as a result of greatly increased imports during the past year. The stockpile of penicillin is estimated to be sufficient, according to US experience, to meet the needs of more than 800,000 troops in active combat for one year.

6. Economic and Social Effects

a. Economic Effects

Modern industry, accounting for about one-half of gross industrial output, and industrial construction would come to an almost complete halt under the assumed attack. There would be a sharp setback to North Vietnam's economic development program. The repercussions of the breakdown of modern industry would, however, be limited by the primarily self-sufficient nature of the subsistence sector, which supports about 85 percent of North Vietnam's 18 million people. The impact of even a complete loss of its modern industrial base would be a matter of direct concern to only a small element of the North Vietnam society. Most of the population leads a fairly primitive life with simple wants and needs. North Vietnam's small modern economy is not consumer-oriented. Only a small segment of the society would find its daily routine or standard of living measurably impaired if the industrial base ceased to operate. More than one-half million nonagricultural workers would be released from their jobs, but most of these workers would undoubtedly be reemployed in reconstruction and transportation. The morale and productivity of the nonagricultural labor force probably would decline because of the transfer from normal work, the regime's probable demand for further amounts of uncompensated labor, and the separation from families as a result of new job assignments or the probable further evacuation of dependents from urban areas. But these effects would be felt directly by such a small segment of the population that they would neither control the reactions of the rest of the country nor be compelling enough to shape the attitude of the policy-makers.

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The further decrease in the normally tight supplies of food and other essential consumer goods as a result of the disruption of the transportation system and denial of imports might also have a harmful impact. North Vietnam is basically self-sufficient in food, however, and the distribution problems resulting from the disruption of transport could lead at the most to only minimal food shortages in some smaller urban areas and in the already food-deficit regions in the southern, northwestern, and northeastern parts of the country. Evacuation of urban residents, which is currently underway, would undoubtedly be stepped up to relieve food shortages. The recent replenishing of food stocks from the fall harvest plus the proximity of North Vietnam's major urban areas -- Hanoi, Haiphong, and Nam Dinh -- to surplus rice-growing regions would permit adequate supplies of food to these areas. The likely influx of evacuees from urban centers and other food-deficit areas into normally self-sufficient rural areas would reduce per capita availabilities of food there, and possibly would provide the hostility of local residents toward the newcomers.

Severe problems probably would not arise in the supply of essential civilian goods. Other than food the major requirement is for clothing, but shortages of clothing would be felt only in the long run and would be ameliorated by North Vietnam's moderate climate. With the exception of combat-related pharmaceuticals, medicines are in short supply and could become a critical item, but resupply could be a relatively simple logistic problem.

b. Effect on the Waging of the War

The type of war currently being waged by the Communist forces in South Vietnam remains essentially guerrilla warfare. It is characterized by hit-and-run tactics and a general unwillingness of Communist forces to engage in frontal combat with the opposing forces.

The Communist forces in South Vietnam have only a minimal dependence on the economy of North Vietnam. The guerrilla forces are almost completely self-sufficient. The main force is dependant for supplies from external sources for only the smaller part of its needs -- principally quartermaster goods such as medical supplies and signal equipment and weapons and ammunition. These supplies are not produced in

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North Vietnam and are supplied almost wholly by other Communist countries.\* Thus a collapse of the modern industrial sector would have almost no impact on the military activity in South Vietnam.

The effort required to satisfy the logistic requirements of the Communist main forces in South Vietnam is small. At the level of combat prevailing during most of 1965 the requirement for logistic support from abroad is estimated at about 12 short tons per day. Even at the current projection of the probable maximum buildup of PAVN and Viet Cong main forces during 1966, the external logistic requirement would be only 165 short tons a day.\*\*

The North Vietnamese have developed an effective and relatively invulnerable system to infiltrate men and supplies into South Vietnam. The capacity of the recently improved primary infiltration route through the Laotian panhandle has been reduced by US/GVN interdiction measures to an estimated 400 short tons per day. This capacity is more than adequate to meet the current logistic requirement of the Communist main forces in South Vietnam. The capacity of this route would also meet the logistic requirements of an expanded main force engaging in a scale of combat considerably more intensive than that waged to date.

If both the buildup of the PAVN/VC main forces and the scale of combat should approach the point of exhausting the capacity of the supply funnel through Laos, the North Vietnamese could then resort to sea infiltration or the use of Cambodia to augment the flow of supplies.

During 1965 the US/GVN air offensive included a determined effort to cut off the flow of supplies moving through Laos. In spite of this interdiction, the North Vietnamese have demonstrated a remarkable ability not only to maintain and to increase the movement of men and supplies but also to increase the basic capacity of this supply network. Although the attack analyzed in this memorandum would make logistic support more difficult and require more emergency measures, the tonnages involved are so small that there would seem, in effect, to be no way, short of physical occupation, to attain a complete halt in the flow of men and supplies through Laos into South Vietnam.

\* A fairly important exception is the procurement through normal trade channels of medical supplies from some non-Communist Countries.

\*\* This requirement is calculated for a main force of 155 PAVN/VC battalions engaged in combat once in every three days.

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To maintain the logistic support of the Communist forces in South Vietnam, the North Vietnamese also need an effective transport system within North Vietnam. Although the air offensive to date has disrupted and hindered the operation of the North Vietnamese transport system, it has not reduced it to a level below that needed to maintain essential traffic. During the last quarter of 1965 the volume of freight that was moved into the southern provinces of North Vietnam approached and may even have exceeded normal levels. The inventory of motor trucks, despite the losses from air attack, actually increased during 1965. It should be noted finally that the supply of the probably most essential factor -- petroleum -- was not reduced to critical levels during 1965. Moreover, even the intensified attack analyzed in this memorandum would not prevent the North Vietnamese from maintaining at least its essential imports of petroleum -- and hence its ability to supply the forces in South Vietnam.

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**C. Military Supply Targets**

Fixed targets in the North Vietnamese military supply system include 15 troop barracks, 5 ammunition depots, and 6 supply and ordnance depots.\* These facilities primarily support PAVN activity in the north; nevertheless, a number of these facilities also serve as training areas for Viet Cong forces and are supply points for PAVN and VC forces operating in South Vietnam.

Destruction of these facilities would require 1,580 sorties composed of 1,044 strike aircraft and 536 support aircraft. The ordnance requirement for these targets is estimated to be <sup>1,846</sup>1,596 tons and perhaps as many as 300 civilian casualties might result from such attacks. After initial attack, most of these targets would probably require continuing restrikes to prevent repair and reuse of these facilities.

As noted earlier, the postulated attacks against petroleum facilities and the transportation network would complicate but probably not cut off the flow of supplies into these facilities and prevent their eventual distribution to military consumers. Under the Rolling Thunder attacks of 1965 approximately <sup>18</sup>16 percent of North Vietnam's total barracks facilities, about <sup>65</sup>4 percent of the ammunition depot capacity, and about 5 percent of its supply and ordnance depot capacity were destroyed. As a result, the regime appears to have dispersed some facilities of this type into the countryside where they will be less vulnerable to air attacks of the type envisaged in this memorandum. The extent to which the dispersal process has gone forward is unknown but it will have the effect of lessening the vulnerability of the military supply system to air attack. Construction of temporary field facilities to provide shelter for troops and most military supplies is fairly simple. Construction of storage facilities for ammunition and ordnance may be more difficult because of the need for protection from the effects of North Vietnamese climate. On balance, destruction of these targets would impede the flow of material in the military supply system and disrupt military training programs in North Vietnam but it does not appear likely to decisively cripple the military effort of the regime.

\* For a listing of these targets, see Table 3.

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D. Manpower Targets

North Vietnam is an essentially agrarian society with more than 85 percent of the population living in rural areas. Because of this dispersion of the bulk of the population in rural areas, aerial attacks aimed at immobilizing North Vietnamese manpower resources must be limited to the urban centers of population. The urban population of North Vietnam is estimated at about 1,344,000, of which approximately 70 percent, or 928,000, are concentrated in the eight largest cities. These cities and their populations are:

Hanoi	-	475,000
Haiphong	-	210,000
Nam Dinh	-	90,000
Vinh	-	46,000
Thanh Hoa	-	35,000
Thai Nguyen	-	28,000
Viet Tri	-	26,000
Dong Hoi	-	18,000

Area bombing attacks of the type mounted against Japan in World War II could be mounted against these cities. However, several factors suggest that such attacks against North Vietnamese cities would not result in as high a proportion of casualties as those resulting from the attacks against Japan. Unlike the very high proportion of wooden structures in Japanese cities, brick and masonry construction is a common feature of North Vietnamese cities. Traditional Asian methods of construction with wood and fibres tend to be seen chiefly on the outskirts of the larger cities of North Vietnam and do not predominate except in the smaller towns and villages. Because of their construction, North Vietnamese cities do not appear to be as vulnerable to incendiary attack and fire damage as were Japanese cities. Further, differences in the layout of North Vietnamese cities further decrease their vulnerability to bombing damage. For example, the system of wide boulevards which compartment the city of Hanoi and the network of canals which runs through Haiphong city constitute fairly

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effective firebreaks. Other examples of differences in urban layout are Thai Nguyen, in which the two main built-up areas are separated from one another by a few miles of rice fields and scattered dwellings, and Viet Tri, in which several built-up areas are dispersed along the banks above the junction of two rivers.

There are also good indications that the regime's civil defense program is more effective than the Japanese program in World War II. Partial evacuation of the larger North Vietnamese cities has already been undertaken as was the case in Japan prior to the attacks of spring 1945. However, the early warning system of the DRV and its shelter programs in the cities appear to be better conceived and, during the attacks of 1965, better carried out than was the case in Japan. Lastly, the regime has made it clear to the North Vietnamese people that they must expect air attacks -- at least some of the casualties in Japan are credited to the government-sponsored belief that serious bombing attacks could never occur.

For these reasons it is believed that casualties (the total of killed and wounded) resulting from area bombing of North Vietnamese cities are likely to be substantially less than was the case in Japan. For purposes of estimating the possible results of such a program in North Vietnam it has been arbitrarily assumed that casualties would run at two-thirds the rate encountered in Japan. An average 2.4 percent of the urban population of Japanese cities became casualties; in North Vietnam, the rate would be on the order of 1.6 percent. On this assumption, casualties in the eight cities considered as targets for air attacks would be about 14,800 persons.

Only crude estimates of the quantities of ordnance required to inflict these casualties can be made. One ratio of 9 tons: 1 casualty, based on the average of three sample cities, is provided by the US bombing survey of Japan. Using this ratio to estimate the bomb tonnage required to inflict 14,800 casualties, estimated ordnance required would be on the order of 133,200 tons, <sup>4,000 to 5,000 B-52 sorties would be required to deliver this ordnance.</sup>

The timing of urban area attacks would be a major factor affecting casualties in North Vietnam. As in Japan, where more than half of the total casualties resulting from the area bombing program occurred in the first massive attack of March 1945, the highest proportion of casualties in North Vietnam could also be expected to result

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from the first attack. Casualties in the DRV are likely to be even less if such area bombing attacks are mounted after the fixed target attacks upon electric power and other industrial facilities. As noted earlier, immobilization of industrial facilities could lead to the evacuation and relocation of as much as half the urban population, constituting a drastic reduction in the number of persons potentially exposed to area raids.

Under conditions of continuing industrial activity, urban area bombing attacks would probably have its greatest effect upon North Vietnam's limited supply of skilled manpower. Approximately 85 percent, or about 255,000, of North Vietnam's skilled manpower supply lives and works in the eight cities considered as targets. Roughly 150,000 of this total is concentrated in the two cities of Hanoi -- about 105,000, and Haiphong -- 45,000. Nevertheless, even if three-fourths of the estimated possible casualties in the eight target cities constituted skilled manpower, only about 4 percent of the total skilled labor force would be affected. Qualitatively, the manpower loss to the regime from these air attacks would be most severe in the Hanoi-Haiphong area since the concentration of the more advanced industrial facilities in this area means that the most highly skilled among the labor force are likely to become casualties.

Extensive physical damage would also result from these attacks and a large proportion of the urban population would evacuate to near-by rural areas. In these areas, which have high population densities and a relatively large cadre force, most of these evacuees could be mobilized for essential jobs in reconstruction, transportation, and agriculture. In the short-run, the organizational effort necessary to reallocate most of the urban labor force in addition to implementing further defense measures and the necessary adjustments in the agricultural labor force would strain the limited management capabilities of North Vietnam's cadre force. Much of the manpower made available to the regime would be wasted through irrational assignments, and many urban workers would probably be left to their own devices long enough to scatter in to sparsely populated areas where a presently inadequate control system would make it almost impossible to channel them into essential jobs. The length of time needed for the regime to make the required adjustments is unknown, but it seems likely that over time the problem could be managed. The existence of [redacted]

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[redacted] a reasonably well-disciplined Vietnamese Workers Party apparatus of around 900,000 members would be prime assets in the regime's attempts to solve this problem. Nevertheless, the morale of the nonagricultural labor force would probably decline with a consequent lowering of its potential productivity due to transfers from normal jobs, separation from families, and the probable demand for further amounts of uncompensated labor.

North Vietnamese industry does not directly support the war effort in South Vietnam and the direct links between North Vietnam's urban society and the war in the south are few. The casualties, physical damage, and the disruption attending the dispersion of urban populations into rural areas resulting from attacks on these cities are not likely by themselves to seriously shake the determination of the leadership to continue the war. Loss of skilled manpower and destruction of industrial facilities do increase the cost of pursuing the war; but the bill for these losses is most likely to be calculated in terms of the eventual long-range goal of North Vietnamese industrialization -- a goal which the regime clearly sees as secondary to goal of reunifying Vietnam.

The total effect of these attacks upon the morale of the North Vietnamese population is difficult to foresee. The Rolling Thunder attacks of 1965 appear to have increased the willingness of the population to accept the regime's calls for sacrifices in order to pursue the war in the south. The US survey of the effects of bombing upon Japanese morale points out that popular morale began to disintegrate when news of Japanese Military reverses in the western Pacific became known and that the chief effect of area bombing attacks was an increase in the rate of decline of popular morale. If the Japanese analogy holds true for North Vietnam, the course of the war in South Vietnam is likely to have greater impact upon popular morale than attacks against urban areas.

#### E. Agriculture

The North Vietnamese economy is basically one of subsistence agriculture. The country imports little food even in poor agricultural years and depends largely

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on domestic food production to feed its population. More than 80 percent of the population is engaged in agriculture, which in 1964 accounted for almost one-half of the gross national product (GNP). The bulk of this population lives on food produced, processed, and stored locally and it is likely to be difficult either to destroy appreciable quantities of food stuffs or to drastically interfere with agricultural production processes by means of aerial attack. However, a relatively small shortfall in agricultural production resulting from air attacks could aggravate an already tight food situation in view of the increased food requirements generated by the expanded war effort.

Perhaps the only agricultural target suitable for aerial attack is the levee system in the Red River delta. In order to inflict maximum damage to the rice crop -- the staple food in North Vietnam -- these levees would have to be breached at some point in the period mid-July to mid-August when the Red River is at its height. During this period, the level of the Red River -- contained by an extensive system of levees -- is considerably above the level of the surrounding plain. Also during this period, the newly transplanted fall rice seedlings, which normally produce about two-thirds of the annual rice harvest, are most vulnerable to damage.

The areas most vulnerable to flooding if the primary levees of this system were breached are the Ha Dong area southwest of the Red River and the Ha Bac area northeast of the river. A secondary system of levees in these areas has tended to confine the damage from major floods in the past to roughly 200,000 hectares,\* or almost one-quarter of the total area. Breaching of the secondary levees could substantially increase the acreage flooded. If only the main levees were breached, it is estimated that the crop loss would be on the order of several hundred thousand tons of rice -- or less than 10 percent of the average annual harvest in recent years. Even if the secondary levees were also effectively breached, the decrease in rice production is unlikely to exceed three-quarters of a million tons.

Successful breaching of these levees would also affect the one and one-half million people in this area, which includes the city of Hanoi. Further, most of the industrial, commercial, and military activity in Hanoi and its suburbs would be temporarily halted until the water receded.

\* One hectare is equal to 2.471 acres.

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Three factors -- the timing of the attacks on the levees, the problem of precision in bombing a small target with heavy ordnance, and North Vietnamese counter-measures -- suggest that there is only a marginal chance of successfully causing extensive flooding by attacking these levees with conventional weapons. As regards the timing of the attacks, they must be mounted within the one month period from mid-July to mid-August when the river is highest -- above 33 feet -- and the fall rice crop is most vulnerable to flood damage. Within this time period, the attack must follow an unusually high flood stage (the historic highs of the river in flood at Hanoi have been just under 39 feet) because the heights of the primary levees run from 42-49 feet.

As for the factor of precision in bombing, the objective is to create a series of overlapping craters across the entire crown of the levee (a distance of approximately 80 feet when the river is at the 33 foot stage) the lips of which are below the water level in the river. If achieved, the scouring action of water rushing through the breach would rapidly deepen and widen the break. A suggested means of creating the series of overlapping craters is with trains of 11 1,000 pound general purpose bombs which penetrate about 10 feet in average soil and produce craters about 37 feet in diameter. The following table shows three assurance levels of cutting the levee when the river is at the 33 foot level:

<u>Assurance</u>	<u>No. of Trains</u>	<u>No. of 1,000 lb. G.P. Bombs</u>	<u>Tonnage</u>
50%	5	55	27.5
70%	6	66	33.0
85%	8	88	44.0

These assurance levels apply only to one breach; from two to four separate and almost simultaneous breaches are probably required to achieve the type and extent of flood damage discussed above. Breaching the levees at one point requires heavy bomb loads and accurate delivery; breaching them at multiple points at the same time is likely to be even more difficult. The existence of heavy anti-aircraft defenses in the same general area where the levees can be most effectively attacked further compounds the difficulty.

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As regards countermeasures, the North Vietnamese are well aware of the importance of the levee system to life in the Red River delta and the regime has maintained and strengthened the system over the years. The existence of a secondary system of levees, which are not considered as targets for air attack, tends to limit the effects of breaching the primary system. Well before the initiation of US air attacks in 1965, regime discussions of the importance of the levee system highlighted the success of the Viet Minh in countering the effects of French destruction of levees and dams which suggests that past experience has in part prepared the regime for such an eventuality. One obvious method of countering the effects of a breach in the levees in the target area is to deliberately breach a number of the levees upstream and divert the water into less important agricultural areas. Defensive breaching of this type could rapidly drop the level of flood water at Hanoi by as much as six feet.

[REDACTED]

[REDACTED]

The factors of timing, bombing difficulty, and North Vietnamese countermeasures all argue against attempting to breach the levees; similarly, the regime would be quick to exploit the political advantage provided by such inhumane attacks. Even on the assumption that such attempts were made and were successful there are still grounds for believing that the regime would be able to absorb such a blow. Loss of life, homes, and places of work would be exceedingly disruptive to the social order in the affected areas in the short-run but, over the long-run, the effect upon rice availabilities would probably be the hardest problem for the regime. The loss of several thousand tons of rice, particularly in a year of below-average harvests, would force the regime to seek outside sources of supply. In this case it is highly likely that Communist China, which in an average year produces 75-85 million metric tons of rice could provide the necessary amount. Under conditions of continuing air interdiction of the land links between the DRV and Communist China, transport of such supplies would be difficult but not impossible.

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Table 1

## Fixed Targets Attacked Under Assumed Intensified US/GVN Air Offensive

		Prime Economic Targets					
JCS Target Number	Electric Power Facilities a/ *	Capacity (kilowatts)	Estimated Sorties			Ordnance Requirements (Tons)	
			Strike	Support	Total		
	Hanoi Thermal Powerplant (TFP)	32,500	4	18	22	9	25X5
	Thai Nguyen TFP	24,000	4	12	16	9	
	Hon Gai TFP	15,000	4	12	16	9	
	Dong Anh Transformer Sub-station		6	16	22	13.5	
	Viet Tri TFP	16,000	4	20	24	9	
	Haiphong Cement Plant TFP	12,000	4	16	20	9	
	Haiphong TFP	6,000	4	18	22	9	
	Lao Cai TFP	8,000	4	12	16	9	
	Total Capacity:	<u>113,000</u>					
Estimated Total Sorties Required: <del>128</del>							
Strike: 34							
Support: 124							
Estimated Total Ordnance Required: 76.5 tons							

\* Footnotes follow on p.

Table 1 (Continued)

Prime Economic Targets							
JCS Target Number	Petroleum Storage Facilities b/	Capacity (Metric Tons)	Estimated Sorties			Ordnance Requirements (Tons)	
			Strike	Support	Total		
	Haiphong	72,000	70	24	94	157.5	25X5
	Hanoi (Thanh Am)	34,000	<del>40</del> <sup>5</sup>	24	74	112.5	
	Phuc Yen	14,000	72	24	96	162.0	
	Duong Nham	14,000	38	20	58	85.9	
	Nguyen Khe	13,000	58	20	78	130.5	
	Do Son	8,000	22	12	34	49.5	
	Bac Giang (Phu Lang Thuong)	6,000	<del>32</del> <sup>26</sup>	16	<del>48</del> <sup>36</sup>	45.0	
	Viet Tri	4,000	20	20	40	45.0	
	Kep	3,000	72	<del>42</del> <sup>32</sup>	104	162.0	
	Total Capacity:		168,000				
Estimated Total Sorties Required:		626	614				
Strike:		434	422				
Support:		192					
Estimated Total Ordnance Required:		949.5 tons					

Table 1 (Continued)

		Prime Economic Targets				
JCS Target Number	Transportation Facilities	Estimated Sorties			Ordnance Requirement (Tons)	
		Strike	Support	Total		
	Hai Duong Railroad/Highway Bridge over Song Thai Binh	35	19	54	49.5	25X5
	Hanoi Railroad/Highway Bridge over Red River	34	24	58	76.5	
	Hanoi Railroad/Highway Bridge over Song Duong (Canal Des Rapides)	28	20	48	63.0	
	Viet Tri Railroad/Highway Bridge over Song Lo (Riviere Claire)	22	24	46	49.5	
	Dap Cau Railroad/Highway Bridge over Song Cau	28	16	44	63.0	
	Haiphong Highway Bridge over Song Da Bach	35	18	53	50.0	
	Lang Son Railroad/Highway Bridge over Song Ky Cung	22	16	38	49.5	
	Co Trai Railroad/Highway Bridge over Song Thuong	78	16	94	48.0	
	Bac Giang (Phu Lang Thuong) Railroad/Highway Bridge over Song Thuong	36	20	56	49.5	
	Cao Nung Railroad Bridge over Song Hoa	88	16	104	39.0	
	Hai Duong Railroad/Highway Bridge E over Song Rang	35	19	54	49.5	
	Lang Con Railroad Bridge NW	28	16	44	42.0	
	Kep Highway Bridge over Song Thuong	35	18	53	50.0	
	Thai Nguyen Highway Bridge over Song Cau	35	18	53	50.0	
	Ha Gia Highway Bridge over Song Cong	22	16	38	49.5	
	Dan Phuong Highway Causeway over Song Day	8	16	24	18.0	

Table 1 (Continued)

JCS Target Number	Transportation Facilities	Prime Economic Targets			Ordnance Requirement (tons)
		Estimated Sorties Strike	Support	Total	
	Xuan Mai Highway Bridge N. over Song Con	34	24	58	12.0
	Lang Dang Railroad Bridge over Song Thuong	88	16	104	36.0
	Long Knap Highway Bridge	40	16	56	90.0
	Bac Can Highway Bridge over Song Cau	35	18	53	50.0
	Lang Luong Highway Bridge over Song Mo Ga	35	18	53	50.0
	On Highway Bridge over Song Thuong	32	16	48	9.0
	Me Xa Highway Bridge over Song Ky	35	18	53	50.0
	Chieng Chang Highway Bridge	32	16	48	48.0
	Loc Binh Highway Bridge	34	16	50	76.5
	Xuan Mai Highway Bridge SW over Song Day	50	16	66	112.5
	Vu Chua Railroad Bridge over Suoi Ngang	88	16	104	39.0
	Ba Chanh Highway Bridge N	22	16	38 30	33.0
	Lam Highway Bridge NE	14	16	30	21.0
	Yen Vien Railroad Classification Yard	6	24	30	13.5
	Hanoi Railroad Car Repair Shops at Oa Lam	6	24	30	13.5

Table 1 (Continued)

Prime Economic Targets		Estimated Sorties			Ordnance Requirement
JCS Target Number	Transportation Facilities	Strike	Support	Total	(Tons)
	Hanoi Railroad Station and Classification Yard	18	24	42	40.5
	Thai Nguyen Railroad Station Yards and Shops	8	24	32	18.0
	CamPha Port Facilities	24	16	40	54.0
	Hon Gai/Bai Chay Port and Naval Complex	28	14	42	63.0
	Haiphong Port Complex	80	28	108	180.0
	Thanh Hoa Lock	26	24	50	58.5
	Ben Thuy Lock	10	24	34	15.0
	Nguyen Quang Lock #1	14	16	30	21.0
	Qua Nhue Ha Lock #2	14	16	30	21.0
	Ben Thon Lock #1, Song Thuong Canal	12	16	28	18.0
	Van Cau Lock #5, Song Thuong Canal	12	16	28	18.0
	Lu Yen Lock #7	12	20	32	18.0
	Hanoi Port Facilities	24	24	48	54.0
Estimated Total Sorties Required: 2,226					
Strike: 1,432					
Support: 824					
Estimated Total Ordnance Required: 2,029.5 tons					

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Table 1 (Continued)

		Prime Economic Targets				
JCS Target Number	Transportation Facilities	Estimated Sorties			Ordnance Requirement (Number) c/	
		Strike	Support	Total		
	CamPha mineable area	8	12	20	25	25X5
	Hon Gai mineable area	20	12	32	74	
	Haiphong mineable area	36	16	52	91	
	Estimated Total Sorties Required: 104					
		Strike: 64				
		Support: 40				
		Estimated Total Ordnance Required: 190				

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Table 3

## Fixed Targets Attached Under Assumed Intensified US/GVN Air Offensive

JCS Target Number	Barracks	Military Supply Targets			Estimated Sorties	Ordnance Requirement (Tons)
		Strike	Support	Total		
		44	24	68		99
	Xuan Mai SW	28	24	52		63
	Xuan Mai NNW	100	32	132		225.5
	Ha Dong Barracks/Supply Depot	46	20	66		103.5
	Vinh Yen N	34	20	54		76.5
	Son Tay SW	64	28	92		144
	Kep Ha NE	24	16	40		54
	Trai Thon	26	20	46		58.5
	Vinh Yen NNE	18	16	34		40.5
	Phu Tho NW	18	16	34		40.5
	Ngoc Thai	54	16	70		121.5
	Son Bong SSE	20	16	36		45
	Kep S	18	16	34		40.5
	Chi Ne	132	26	160		297
	Bien Son NNE	8	8	16		18
	Non Son					

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